



April 1, 1991

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**A SEVENTH YEAR:  
IRAQ, NEW MADRID, MPI**

We began in global tension, weathered fears of the earthquake that never was, witnessed a six week blitzkrieg war, and now a lingering recession. With our Earthquake Team of last Fall we addressed one of these shaping events, but the others were only the backdrop before which we explored the ideas and equations of Calculus and Physics.

In our own small way, just as a new peace may grow in the Middle East, we hope our students may take their hard-won MPI lessons with them into college next year. It is never easy to take classes five days a week in the dark hours of morning, and to struggle toward the painful realization that study is now in your own hands, that your performance is strictly up to you, that you must become a professional student. But these lessons are unavoidable, and we hope, best imprinted early. If, in addition to teaching the elements of Calculus and Physics, we have succeeded here, we are content.

Best of luck to the 1990-91 class, and thanks to their parents for unflinching support.

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**TEAMS TEST TEAM 1991 - RESULTS**

Under the new TEAMS testing procedure, in which the team takes one test (divided into six sections) together in one room over a period of 2 hours, our MPI students did exceptionally well. Our team of 8 students received 152 points for a 4th place position, while 2nd and 3rd places tied at 153 points and 1st place was only 158 points. This was

by far the best score the MPI has ever received. We are very pleased at how well our group did and congratulate them all.

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**MATHEMATICS AWARENESS WEEK 1991**

**APRIL 21-27**

The theme of the national Mathematics Awareness Week this year is "Mathematics: It's Fundamental". The MPI has decided to celebrate this theme by assembling teams of 3 students each to visit some grade 7 or 8 classes in the area and give a 30 minute mathematics presentation. Included will be illustrations of the use of mathematics in a wide variety of careers, and the distribution and discussion of an MAA pamphlet on what mathematics is needed in high school for careers later. We hope to entertain and illuminate some young minds, while giving our own MPI students a chance to share what they know.

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**CALCULUS READINESS EXAMS**

During the first week of May the Mathematics Coordinator will travel to each of the six high schools participating in the MPI to administer the MAA Calculus Readiness Test, a 25 question diagnostic test designed to roughly determine how prepared a student is to take calculus. It covers analytic geometry, algebra, and some trigonometry. A score of 12 or above is required to attend the MPI, although occasionally lower scores are accepted provided a transcript and two recommendations are received, and an interview with the Director takes place.

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Of course, this little test is by no means definitive, and in fact, a student's commitment more often determines his or her success at the MPI than a score on one introductory test. However, this test has proved to be effective as long as it is complemented by careful screening done at each individual high school by counselors and teachers who know the students in question.

We hope to see some of you soon!

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### ENRICHMENTS

#### FOLLOW UP

The students who participated in our first experiment with a Test Anxiety Workshop, presented by David Wakefield of the UMKC Counseling and Placement Center, had these written responses:

- This was far and away the best enrichment yet. We learned how to recognize stress and anxiety and to handle it.
- Even when we are in the middle of a test we can do things to relieve anxiety such as take deep breaths or close our eyes and project positive thoughts. He helped me to understand exactly what was happening when I was taking a test, knew the material and still did poorly.
- I think he helped me; now if I can only remember to do what he told me when I get into a stressful test situation, I think I'll be okay.

Our guest of Feb. 20, Shelley Wolff, a civil engineer, elicited these comments:

- This was great because we had just gone over this material and so we knew exactly what she was referring to.

-- I did not expect to be affected by this presentation, but the speaker did a good job of making her profession a bit more interesting than I had originally thought it to be.

-- I liked how she explained what she did and how they were paid for out of our taxes. I never realized that and it's something we should know.

On March 6, Larry Deaton spoke on Birth Order, calling forth these remarks:

- He was one of the best speakers we have had.
- ...He was an exceptional speaker and the topic relates to everybody.

The day after Larry's talk, we even took a hand count of various birth orders and discovered that of the 37 students present that day, 16 were 1st borns or only children, 14 were 2nd children, and 7 were 3rd born -- it seems the era of large families is past. Of the 8 MPI staff members (including our secretary), 6 are 1st borns (one being a 'virtual' 1st born), one is a 3rd born, and one is the last born of six.

Friday March 22, was the day 1981 Nobel winning chemist Dr. Roald Hoffmann visited.

Dr. Hoffmann brought with him slides of some beautiful molecules -- simplicity inside complexity. He told us that chemistry is about change, about transforming matter. In one example he revealed to us just how a new "linked rings" molecule was recently designed and constructed. As a second example, he showed how the marvelous hemoglobin molecule is modeled by chemists, and what insights models of greater or lesser accuracy can call forth.

His final message was that the world is interesting because of its infinite variety, that its real beauties lie in complexity.

#### UPCOMING ENRICHMENTS

On April 3 Mike See, an engineer from Mission Operations at NASA will be our special guest and will speak about orbital space stations.

On April 17, Dr. Henry Mitchell will make his 7th visit to the MPI to present his erudite and engrossing talk on Bats: Strange Creatures of the Night.

The 1st of May, Dr. Larry Campbell of the School of the Ozarks will speak on Interesting and Weird Mathematicians, a historical compilation of anecdotes and curious facts about history's finest mathematicians.

Sun. May 5, we make our annual trek to Worlds of Fun, for a day of Physics problems, roller-coasters, stresses, strains, tension, and momentum -- though perhaps not in that order. Our students will have from 10 am until 3 pm to finish their problem packets, with any remaining time to themselves.

Year 7 will end with our annual picnic breakfast on Thurs. May 16 at McCoy Park, and our Awards Presentation on Fri. May 17.

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#### PAST STUDENTS WRITE TO US

ROBERT BROOKS (86-87)  
(Computer Science Major)

"I would have to say that the courses at MPI were higher in quality than most of my college courses for the simple reason that the instructors at MPI care about the students."

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KIM GALLAGHER (86-87)  
(History Major)

"MPI gave me the self-confidence I needed to ask questions and not panic when faced with an overwhelming concept, problem, or semester. I could not have survived some of my course work without it."

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TRANG DU (85-86)  
(Biology and Chemistry Major)

"I think that the MPI is a great program for high school students. It really helped in easing the transition from high school to college life. This is evident by the fact that many of my friends had problems in their first year in college because they did not know what to expect. They weren't as fortunate as I was."

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RHONDA DAVIS (85-86)  
(Biology Major and  
Radiology Technologist)

"Just wanted to say 'hi' to everybody at the Institute. Things are hectic as always with me, going to school full-time and working full-time keeps me extremely busy. Right now I'm on Spring break and using every minute to catch up. I'm taking a 4-day class 9-5 on Sat. & Sun. of the weekends of break to prepare for the MCAT. That's about all that has been going on and believe me I'm not sure if I could squeeze much more in. I hope you all are having a good year!"

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CINDY KLEEMAN (87-88)  
(Political Science Major  
USAF Academy)

"The quality of instruction at MPI is very high. The teachers there spend a lot of time making sure that every student that wants to understand does so. It is very comparable to the classes that I take here."

However, if you want extra instruction or need special attention here, you have to schedule an appointment on your free time as opposed to work sessions at MPI.

...Even though I was not a high achiever at MPI, I did have a good foundation in math and physics. It helped me survive in this environment academically."

CANDI SMITH (88-89)  
(Pharmacy Major)

"I have not taken any math or physics courses since the MPI. However, the quality of those courses was substantially better than many of the hard science courses I have taken. MPI courses were more thorough; the teachers cared if you learned or not.

I suppose my eagerness to compete was enhanced by participation in MPI. Also, I understand the importance of studying and repetition as relating to learning."

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#### 1990-91 FINAL STUDENT QUOTES

"MPI has ... been a terrific experience and I am proud to be a part of it."

Sheri Harrison  
Wm. Chrisman High School  
Independence School District

"The MPI is a power plant of intellectual meltdown that allows us to become everyone else's epitome of intellect."

Jeff Hoskins  
Truman High School  
Independence School District

"MPI is the place to grow as an individual and as a student. It

offers an opportunity to make new friends, get a taste of college life, and receive free college credit."

Nikki Elkins  
Northeast High School  
Kansas City, MO School District

"Calculus is great. There is no better way to start a morning off right than sitting in an undecorated classroom and getting lectured to about something you don't understand. It's great! There is no place else in the world that you can ask questions like 'Where did that come from?' and get away with it."

Chris Bird  
Truman High School  
Independence School District

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#### PROFILES IN SUCCESS

Cary Stokes is an outstanding example of a young man with a goal who was willing to do what had to be done, overcome the obstacles, and make the necessary sacrifices to achieve his goal. Cary was a student here in 1984-85, the first year of the MPI. His goal, as I remember, was to become a pilot in the United States Air Force.

After surviving the MPI, Cary enrolled at the University of Missouri-Columbia, where he earned a Bachelor of Arts degree with a major in Geography in 1989. He then entered pilot training school at Vance AFB in Enid, Oklahoma, and completed pilot training in February 1991. Cary is now stationed at the Rhein Main AFB in Germany. After seeing the events of the Persian War on television I think we can all appreciate the tremendous skills, knowledge and discipline our pilots must have in order to accomplish the extraordinary results they achieved.

We are proud of Cary's accomplishments thus far, and wish him success in the future.

Richard Waring

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A SOLUTION TO  
MATHEMATICS CHALLENGE #17

Recall the problem statement:

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Solve the following system of equations:

$$\begin{aligned}x + 7y + 3v + 5u &= 16 \\8x + 4y + 6v + 2u &= -16 \\2x + 6y + 4v + 8u &= 16 \\5x + 3y + 7v + u &= -16\end{aligned}$$

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SOLUTION:

Notice that in the FIRST equation, if we exchange the variables  $x$  and  $u$ , as well as the variables  $y$  and  $v$ , we have precisely the FOURTH equation, except for the sign of 16 on the right. Likewise the same exchanges in the SECOND equation produce the THIRD equation, with again a change of sign on the right.

So we conclude that  $u = -x$  and  $v = -y$ . Making these substitutions in the First and Second equations yields:

$$\begin{aligned}-4x + 4y &= 16 \\6x - 2y &= -16\end{aligned}$$

Simplifying (dividing the first by 4 and the second by 2) gives:

$$\begin{aligned}-x + y &= 4 \\3x - y &= -8\end{aligned}$$

Then adding the two equations (in order to eliminate the variable  $y$ ) gives:

$$\begin{aligned}2x &= -4, \\ \text{so } x &= -2.\end{aligned}$$

Substituting  $x = -2$  into  $-x + y = 4$  above gives  $y = 2$ . Hence our solution to the original system of equations is:

$$x = -2, y = 2, u = 2, v = -2.$$

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A SOLUTION TO  
PHYSICS CHALLENGE #8

Recall the problem statement:

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'Fiddlesticks' is a remarkably simple, yet fascinating toy. It consists of a plastic ring (of relatively large inner diameter) on a stick. Once the ring is sent spinning by a flick of your fingers, the stick is held vertically. The ring begins to drop (slower than you might expect), and as it comes down the stick, the ring spins faster and falls even slower! By inverting the stick just before the ring reaches the lower end of the stick, the process can be repeated indefinitely.

Why does the spin increase as the ring falls? In fact, why doesn't the ring just fall with the full gravitational acceleration?

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SOLUTION:

First of all, FRICTION from the stick prevents the ring from just falling with the full gravitational acceleration.

Next, we note that part of the stabilization of the spinning ring is a result of the perpendicular force from the stick as the ring spins around and strikes against the stick. The spinning rate therefore INCREASES as the ring falls because some of the ring's potential energy is converted into rotational kinetic energy.

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**MATHEMATICS CHALLENGE #18**

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**THE COOK AND THE CAT**  
(A little logic problem)

The cook believes that at least one of the two is mad. What can you deduce about the cook and the cat?

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[From: Alice in Puzzle-Land, by Raymond Smullyan.]

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**PHYSICS CHALLENGE #9**

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If you lock the brakes on your car while moving at high speed on a wet road, the car will act like an aquaplane. That is, the tires will skim along on a thin sheet of water and will not actually touch the road.

Why does this happen, and why doesn't it always happen on wet roads even when the brakes are NOT applied? Is there any tread design that will minimize this effect?

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[From: The Flying Circus of Physics, by Jearl Walker.]

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**! NOTICE !**

The August 1 newsletter will list the top ten MPI students for 90-91 and all those receiving awards at our May 17 Awards Presentation.

There will also be **IMPORTANT INFORMATION** and advice for the class of 91-92. **TAKE NOTE!**

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